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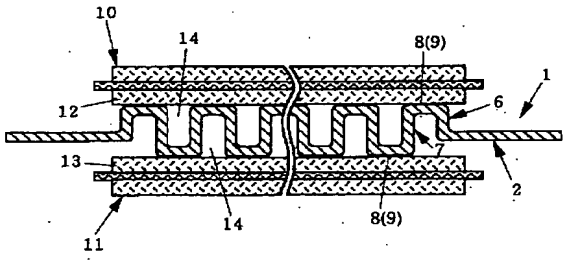
(54)【発明の名称】　燃料電池用セパレータ

(57)【要約】
【課題】単位電池の電極との接触抵抗の小さい燃料電池用セパレータを得る。
【解決手段】ステンレス鋼（ＳＵＳ３０４）をプレス成形することにより内周部６に多数個の凹凸からなる膨出成形部７を形成し、膨出成形部７の膨出先端側端面８に０．０１～０．０２μｍの厚さの金メッキ層９を形成する。燃料電池を形成する際、燃料電池用セパレータ１を、積層された単位電池１０、１１の間に介在させ、単位電池１０、１１の電極１２、１３と膨出成形部７の膨出先端側端面８に形成された金メッキ層９とが当接するように配設し、燃料電池用セパレータ１と電極１２、１３との間に反応ガス通路１４を画成する。



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【特許請求の範囲】

【請求項１】金属製部材からなり、単位電池の電極との接触面に直接金メッキを施したことを特徴とする燃料電池用セパレータ。

【請求項２】該金属製部材をステンレス鋼としたことを特徴とする請求項１記載の燃料電池用セパレータ。

【請求項３】該電極と対向して反応ガス通路を画成することを特徴とする請求項１又は２記載の燃料電池用セパレータ。

【請求項４】金メッキの厚さを０．０１～０．０６μｍとしたことを特徴とする請求項１乃至３記載の燃料電池用セパレータ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、燃料電池用セパレータに関するものであり、特にセパレータと単位電池の電極との接触抵抗の小さいものに関する。

【０００２】

【従来の技術】燃料電池には、固体高分子型燃料電池、燐酸型燃料電池及び溶融炭酸塩型燃料電池等がある。これらの燃料電池には、酸素含有ガスと水素含有ガスとの電気化学反応により起電力を生ずる単位電池と、積層された該単位電池の隣り合う単位電池間に介在し、隣り合う単位電池双方の電極と接触して該両単位電池を電気的に接続するとともに反応ガスを分離する作用をなすセパレータとが備えられ、該セパレータとして、固体高分子型燃料電池及び燐酸型燃料電池には緻密質カーボン材が使用され、溶融炭酸塩型燃料電池にはＮｉ／ＳＵＳクラッド材が使用されている。

【０００３】

【発明が解決しようとする課題】しかし、これら緻密質カーボン材を使用したセパレータ及びＮｉ／ＳＵＳクラッド材を使用したセパレータは単位電池の電極との接触抵抗が大きいという問題点がある。そこで、本発明はかかる問題点を解消するためになされたものであり、単位電池の電極との接触抵抗の小さい燃料電池用セパレータを提供することを課題とする。

【０００４】

【課題を解決するための手段】第１の発明の燃料電池用セパレータは、金属製部材からなり、単位電池の電極との接触面に直接金メッキを施したことを特徴とする。第２の発明の燃料電池用セパレータは、請求項１記載の燃料電池用セパレータにおいて、該金属製部材をステンレス鋼としたことを特徴とする。第３の発明の燃料電池用セパレータは、請求項１又は２記載の燃料電池用セパレータにおいて、該電極と対向して反応ガス通路を画成することを特徴とする。第４の発明の燃料電池用セパレータは、請求項１乃至３記載の燃料電池用セパレータにおいて、金メッキの厚さを０．０１～０．０６μｍとしたことを特徴とする。

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【０００５】該セパレータの該電極との接触面に直接金メッキを施すことにより、該セパレータと該電極との接触抵抗が小さくなり、該セパレータと該電極との間で電子の導通が良好に行われる。

【０００６】

【発明の実施の形態】金属製部材には、アルミニウム、チタン、Ｎｉ－鉄合金、ステンレス鋼等を使用できるが、耐腐食性の観点からステンレス鋼を使用することが望ましい。セパレータと電極との間に形成する反応ガス通路は、電極に溝を形成して画成してもよく、セパレータに凹凸を設けて画成してもよいが、特に電極がカーボン製の場合は金属製のセパレータ凹凸を設けて反応ガス通路を画成することが望ましい。セパレータに施す金メッキの厚さは制限されないが、実験の結果、該厚さを０．０１～０．０６μｍとした場合に接触抵抗が特に小さくなりかつピンホールの発生もないことが明らかとなったため、該金メッキの厚さは０．０１～０．０６μｍとすることが望ましい。本セパレータは、固体高分子型燃料電池、燐酸型燃料電池、溶融炭酸塩型燃料電池等各種燃料電池に採用することができる。

【０００７】

【実施例】以下、本発明の実施例として、固体高分子型燃料電池に採用される燃料電池用セパレータを図１～５に基づいて説明する。図１に示すように、本実施例の燃料電池用セパレータ１は、ステンレス鋼（ＳＵＳ３０４）を用いたもので、外周部２には反応ガス導入用流通孔３、反応ガス流出用流通孔４及び冷却水流通孔５が穿設され、内周部６にはプレス成形により多数個の凹凸からなる膨出成形部７が形成されている。膨出成形部７の膨出先端側端面８には、０．０１～０．０２μｍの厚さの金メッキ層９が形成されている。図２に示すように、燃料電池を形成する際、セパレータ１は、積層された単位電池１０、１１の間に介在し、単位電池１０、１１の電極１２、１３と膨出成形部７の膨出先端側端面８に形成された金メッキ層９とが当接するように配設され、セパレータ１と電極１２との間に反応ガス通路１４を画成する。

【０００８】セパレータ１の金メッキ層９は、プレス成形されたセパレータ素材に下地メッキを施すことなく、脱脂工程、洗浄工程、表面活性化工程、洗浄工程、部分金メッキ行程、洗浄工程及び乾燥工程をかかる順序で実施して形成した。脱脂工程では強アルカリ系脱脂剤を用いてセパレータ素材の表面に付着した油脂を除去する。表面活性化工程では無機混合酸と有機系インヒビタとを処理剤として用い、セパレータ素材の表面を活性化すると共に平滑化する。部分金メッキ行程では、セパレータ素材に対して電圧を印加したノズルから被メッキ部にメッキ処理液を噴出して部分メッキ層を形成するスパージャ方式を用い、メッキ処理液としてシアン金カリウム溶液を用いてセパレータ素材の膨出成形部７の膨出先端側

端面８に部分メッキする。

【０００９】セパレータ１と単位電池１０、１１の電極１２、１３との接触抵抗に及ぼす金メッキ層９の影響を調査するため、図３に示すように、セパレータ１５から電極基材１６を経てセパレータ１７に電子が導通する際の導通抵抗を測定した。以下、導通抵抗の測定について詳説する。図３に示すように、単位電池１０、１１の電極１２、１３と同じ構成材からなる電極基材１６をセパレータ１と同じ構造及び材質からなるセパレータ１５とセパレータ１７との間に挟持し、さらに、セパレータ１５とセパレータ１７とを定電流電源１８に接続した一対の集電板１９、２０で挟持し、セパレータ１５、１７間に一定電流を供給した際にセパレータ１５、１７間に生ずる電位差をセパレータ１５、１７間に直列接続された電位差計２１で検出し、該電位差を抵抗値に換算して導通抵抗を取得する。この際、集電板１９、２０を絶縁板２２、２３を介して押圧板２４、２５により把持し、押圧装置（図示せず）により押圧板２４、２５を押圧してセパレータ１５、１７の膨出先端側端面２６、２７に所定の大きさの面圧を加える。

【００１０】図４に一定面圧下におけるセパレータ１５、１７の膨出先端側端面２６、２７に形成した金メッキ層２８、２９の厚さと、導通抵抗との関係を示す。図４から明らかなように、金メッキ層２８、２９の厚さが薄くなるほど導通抵抗が小さくなり、０．０６μｍより小さくなるとほぼ一定の導通抵抗となることが明らかとなった。

【００１１】図５にセパレータ１５、１７の膨出先端側端面２６、２７に加える面圧を変化させた際の導通抵抗と面圧との関係（図中、「実施例」と記載）を示す。比較のため、緻密質カーボン製のセパレータとＮｉ／ＳＵＳクラッド材製のセパレータとを作製し、セパレータ１５、１７に代えて緻密質カーボン製セパレータにより電極基材１６を挟持し、面圧を変化させて導通抵抗を測定した際の導通抵抗と面圧との関係（図中、「比較例１」と記載）及びセパレータ１５、１７に代えてＮｉ／ＳＵＳクラッド材製セパレータにより電極基材１６を挟持し、面圧を変化させて導通抵抗を測定した際の導通抵抗と面圧との関係（図中、「比較例２」と記載）をそれぞれ図５に併記する。なお、何れのセパレータにおいても電極基材１６との見かけ上の接触面積は同一である。

【００１２】図５から明らかなように、面圧が大きくなるほど導通抵抗が低下する傾向は、セパレータ１５、１７、緻密質カーボン製セパレータ及びＮｉ／ＳＵＳクラッド材製セパレータ共に同じであるが、一定面圧に対する導通抵抗の大きさは、セパレータ１５、１７が最も小さかった。

【００１３】セパレータ１の耐腐食性を調査するため、腐食の起点となるピンホールが金メッキ層９に存在するか否かを硝酸ばっ気試験（ＪＩＳ　Ｈ８６２１）を実施して確認した。その結果、金メッキ層９の厚さが０．０１μｍ以上ではＣｒの溶出は観察されず、ピンホールが形成されていないことが確認できた。

【００１４】

【発明の効果】第１の発明によれば、燃料電池用セパレータを金属製部材により形成し、単位電池の電極との接触面に直接金メッキを施したので、該セパレータと該電極との接触抵抗が低下し、該セパレータから該電極への電子の導通が良好となるため、燃料電池の出力電圧が大きくなる。第２の発明によれば、該金属製部材をステンレス鋼としたので、耐腐食性が良好となるため、耐久性が向上する。第３の発明によれば、該セパレータが該電極と対面して反応ガスの通路を画成するので、成形の容易な金属製のセパレータにより反応ガス通路を画成することが可能となるため、燃料電池の生産性が向上する。第４の発明によれば、金メッキの厚さを０．０１～０．０６μｍとしたので、燃料電池用セパレータと単位電池の電極との接触抵抗がいっそう小さくなり燃料電池の出力電圧が向上すると共に、該セパレータ１枚当たりの金使用量が少なくてすむためコストダウンが達成される。

【図面の簡単な説明】

【図１】本発明の実施例である燃料電池用セパレータの平面図である。

【図２】上記燃料電池用セパレータと単位電池との接触状態を示す断面図である。

【図３】導通抵抗を測定する手段を示す図である。

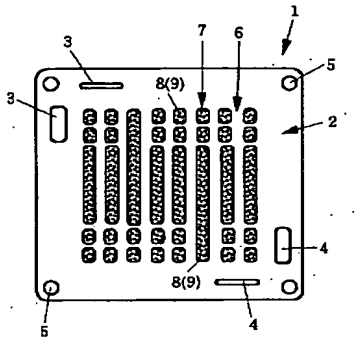
【図４】金メッキ層の厚さと導通抵抗との関係を示すグラフである。

【図５】面圧と導通抵抗との関係を示すグラフである。

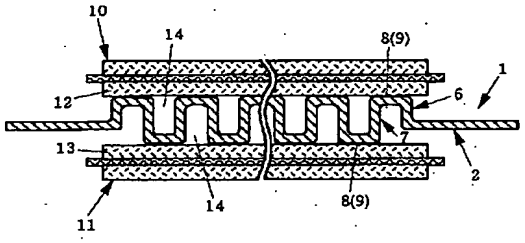
【符号の説明】

１　燃料電池用セパレータ
８　膨出先端側端面
９　金メッキ層
１０　単位電池
１１　単位電池
１２　電極
１３　電極
１４　反応ガス通路

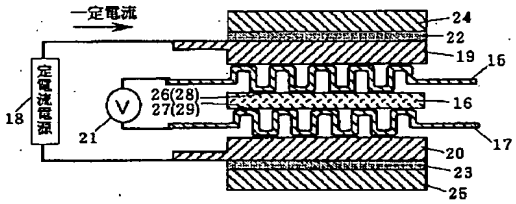
【図１】


1
3
7
6
5
3
8(9)
2
4
8(9)
5
4

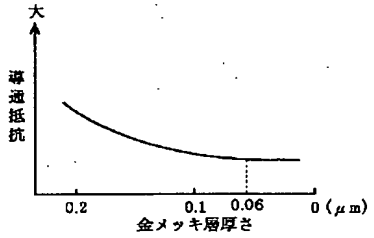
【図２】


10
14
8(9)
1
12
6
7
13
2
14
8(9)
11

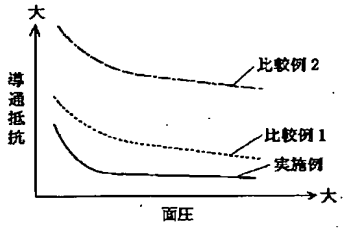
【図３】


一定電流
24
22
19
15
定電流電源
26(28)
27(29)
16
18
21
17
20
23
25

【図４】


大
導通抵抗
0.2
0.1
0.06
0（μm）
金メッキ層厚さ

【図５】


大
導通抵抗
比較例２
比較例１
実施例
大
面圧

PATENT ABSTRACTS OF JAPAN

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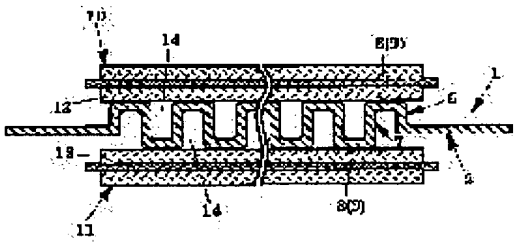
(22)Date of filing : 13.02.1997

(71)Applicant : AISIN TAKAOKA LTD
(72)Inventor : MATSUKAWA MASANORI

(54) SEPARATOR FOR FUEL CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a separator for the fuel cell with small contact resistance with the unit cell electrode.
SOLUTION: Press forming the stainless steel (SUS304) into the corrugate formed part 7 with square-wavy forms in the internal circumference part 6, and the gold plated layer 9 with the thickness of 0.01-0.02μm is formed on the square-wavy top 8 of the corrugate formed part 7. In the case of forming a fuel cell, the fuel cell separator 1 is inserted between the layered unit cell 10, 11 and so arranged that the electrodes 12, 13 of the unit cells 10, 11 and the gold plated layer 9 formed on the square-wavy top 8 of the corrugate formed part 7 closely touch each other and the reaction gas passages 14 are formed between the fuel cell separator 1 and the electrodes 12, 13.



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[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The separator for fuel cells characterized by having consisted of a metal member and performing direct gold plate to the contact surface with the electrode of a unit cell.
[Claim 2] The separator for fuel cells according to claim 1 characterized by using this metal member as stainless steel.
[Claim 3] The separator for fuel cells according to claim 1 or 2 characterized by countering with this electrode and forming a reactant gas path.
[Claim 4] The separator for fuel cells according to claim 1 to 3 characterized by setting thickness of gold plate to 0.01-0.06 micrometers.

[Translation done.]

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3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the small thing of the contact resistance of a separator and the electrode of a unit cell especially about the separator for fuel cells.
[0002]
[Description of the Prior Art] There are a polymer electrolyte fuel cell, a phosphoric acid mold fuel cell, a fused carbonate fuel cell, etc. in a fuel cell. The unit cell which produces electromotive force according to the electrochemical reaction of oxygen content gas and hydrogen content gas in these fuel cells, It has the separator which makes the operation which separates reactant gas while intervening between the unit cells by which this unit cell by which the laminating was carried out adjoins each other, contacting the electrode of both adjacent unit cell and connecting this both unit cell electrically. As this separator Substantia-compacta carbon material is used for a polymer electrolyte fuel cell and a phosphoric acid mold fuel cell, and the nickel/SUS clad plate is used for the fused carbonate fuel cell.
[0003]
[Problem(s) to be Solved by the Invention] However, the separator which used the separator and nickel/SUS clad plate which used these substantia-compacta carbon material has the trouble that contact resistance with the electrode of a unit cell is large. Then, this invention is made in order to cancel this trouble, and let it be a technical problem to offer the small separator for fuel cells of contact resistance with the electrode of a unit cell.
[0004]
[Means for Solving the Problem] The separator for fuel cells of the 1st invention consists of a metal member, and is characterized by performing direct gold plate to the contact surface with the electrode of a unit cell. The separator for fuel cells of the 2nd invention is characterized by using this metal member as stainless steel in the separator for fuel cells according to claim 1. The separator for fuel cells of the 3rd invention is characterized by countering with this electrode and forming a reactant gas path in the separator for fuel cells according to claim 1 or 2. The separator for fuel cells of the 4th invention is characterized by setting thickness of gold plate to 0.01-0.06 micrometers in the separator for fuel cells according to claim 1 to 3.
[0005] By performing direct gold plate to the contact surface with this electrode of this separator, the contact resistance of this separator and this electrode becomes small, and an electronic flow is performed good between this separator and this electrode.
[0006]
[Embodiment of the Invention] Although aluminum, titanium, nickel-iron alloy, stainless steel, etc. can be used for a metal member, it is desirable to use stainless steel from a viewpoint of corrosion resistance. Although the reactant gas path formed between a separator and an electrode may form and form a slot to an electrode and irregularity may be prepared and formed to a separator, when especially an electrode is a product made from carbon, it is desirable to prepare metal separator irregularity and to form a reactant gas path. Although the thickness of the gold plate performed to a separator is not restricted, since it became clear that contact resistance becomes especially small and does not have generating of a pinhole, either, when this

thickness is set to 0.01-0.06 micrometers as a result of the experiment, as for the thickness of this gold plate, it is desirable to be referred to as 0.01-0.06 micrometers. This separator is employable as various fuel cells, such as a polymer electrolyte fuel cell, a phosphoric acid mold fuel cell, and a fused carbonate fuel cell.

[0007]

[Example] Hereafter, the separator for fuel cells adopted as a polymer electrolyte fuel cell is explained as an example of this invention based on drawing 1 -5. As shown in drawing 1 , the separator 1 for fuel cells of this example is what used stainless steel (SUS304), the circulation hole 3 for reactant gas installation, the circulation hole 4 for a reactant gas outflow, and the cooling water circulation hole 5 are drilled in the periphery section 2, and the bulge shaping section 7 which consists of many irregularity by press forming is formed in the inner circumference section 6. The gold plate layer 9 with a thickness of 0.01-0.02 micrometers is formed in the bulge tip side edge side 8 of the bulge shaping section 7. As shown in drawing 2 , in case a fuel cell is formed, a separator 1 intervenes among the unit cells 10 and 11 by which the laminating was carried out, it is arranged so that the electrodes 12 and 13 of the unit cells 10 and 11 and the gold plate layer 9 formed in the bulge tip side edge side 8 of the bulge shaping section 7 may contact, and forms the reactant gas path 14 between a separator 1 and an electrode 12.

[0008] The gold plate layer 9 of a separator 1 carried out and formed the washing process, the parcel-gilding stroke, the washing process, and the desiccation process in this sequence the cleaning process, a washing process, and surface activity chemically-modified degree, without performing substrate plating to the separator material by which press forming was carried out. At a cleaning process, the fats and oils which adhered to the front face of a separator material using the strong-base system degreaser are removed. To a surface activity chemically-modified degree, using an inorganic mixing acid and an organic system inhibitor as a processing agent, while activating the front face of a separator material, it graduates. In a parcel-gilding stroke, parcel plating is carried out to the bulge tip side edge side 8 of the bulge shaping section 7 of a separator material using the sparger method which blows off plating processing liquid from the nozzle which impressed the electrical potential difference to the separator material in the plated section, and forms a partial deposit, using a cyanogen golden potassium solution as plating processing liquid.

[0009] In order to investigate the effect of the gold plate layer 9 exerted on the contact resistance of a separator 1 and the electrodes 12 and 13 of the unit cells 10 and 11, as shown in drawing 3 , the flow resistance at the time of an electron flowing in a separator 17 through an electrode substrate 16 from a separator 15 was measured. Hereafter, it explains in full detail about measurement of flow resistance. As shown in drawing 3 , the electrode substrate 16 which consists of the same component as the electrodes 12 and 13 of the unit cells 10 and 11 is pinched between the separators 15 and separators 17 which consist of the same structure and the same quality of the material as a separator 1. Furthermore, a separator 15 and a separator 17 are pinched with the collecting electrode plates 19 and 20 of a pair linked to a constant current power supply 18. When a fixed current is supplied between a separator 15 and 17, a separator 15 and the potentiometer 21 by which series connection was carried out among 17 detect a separator 15 and the potential difference produced among 17, this potential difference is converted into resistance, and flow resistance is acquired. Under the present circumstances, collecting electrode plates 19 and 20 are grasped with the press plates 24 and 25 through electric insulating plates 22 and 23, the press plates 24 and 25 are pressed with press equipment (not shown), and the planar pressure of predetermined magnitude is applied to the bulge tip side edge sides 26 and 27 of separators 15 and 17.

[0010] The thickness of the gold plate layers 28 and 29 formed in the bulge tip side edge sides 26 and 27 of the separators 15 and 17 under fixed planar pressure at drawing 4 and relation with flow resistance are shown. when flow resistance became small and became smaller than 0.06 micrometers so that from drawing 4 , and the thickness of the gold plate layers 28 and 29 became thin, it became clear to become flow resistance of about 1 law.

[0011] The relation (the inside of drawing, an "example", and publication) between the flow

resistance at the time of changing the planar pressure applied to the bulge tip side edge sides 26 and 27 of separators 15 and 17 to drawing 5 and planar pressure is shown. The separator made from substantia-compacta carbon and the separator made from a nickel/SUS clad plate are produced for a comparison. Replace with separators 15 and 17 and an electrode substrate 16 is pinched with the separator made from substantia-compacta carbon. Relation between the flow resistance at the time of changing planar pressure and measuring flow resistance, and planar pressure (among drawing) It replaces with "the example 1 of a comparison", a publication, and separators 15 and 17, an electrode substrate 16 is pinched with the separator made from a nickel/SUS clad plate, and the relation (the inside of drawing, the "example 2 of a comparison", and publication) between the flow resistance at the time of changing planar pressure and measuring flow resistance and planar pressure is written together to drawing 5 , respectively. In addition, also in which separator, the touch area on appearance with an electrode substrate 16 is the same.

[0012] Although separators 15 and 17, the separator made from substantia-compacta carbon, and the separator made from a nickel/SUS clad plate of the inclination for flow resistance to fall, so that planar pressure becomes large were the same so that clearly from drawing 5 , the magnitude of the flow resistance to fixed planar pressure had the smallest separators 15 and 17.

[0013] In order to investigate the corrosion resistance of a separator 1, the nitric-acid aeration trial (JIS H8621) was carried out and it checked whether the pinhole used as the origin of corrosion would exist in the gold plate layer 9. Consequently, as for the elution of Cr, the thickness of the gold plate layer 9 was not observed by 0.01 micrometers or more, but it has checked that the pinhole was not formed.

[0014]

[Effect of the Invention] Since according to the 1st invention the separator for fuel cells was formed by the metal member, direct gold plate was performed to the contact surface with the electrode of a unit cell, the contact resistance of this separator and this electrode falls and the flow of the electron to this electrode becomes good from this separator, the output voltage of a fuel cell becomes large. Since according to the 2nd invention this metal member was used as stainless steel and corrosion resistance becomes good, endurance improves. Since according to the 3rd invention this separator meets this electrode, and forms the path of reactant gas and it becomes possible to form a reactant gas path with the easy metal separator of shaping, the productivity of a fuel cell improves. Since thickness of gold plate was set to 0.01-0.06 micrometers, while according to the 4th invention the contact resistance of the separator for fuel cells and the electrode of a unit cell becomes still smaller and the output voltage of a fuel cell improves, a cost cut is attained, in order that there may be little amount of the gold used per this separator and it may end.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the small thing of the contact resistance of a separator and the electrode of a unit cell especially about the separator for fuel cells.

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PRIOR ART

[Description of the Prior Art] There are a polymer electrolyte fuel cell, a phosphoric acid mold fuel cell, a fused carbonate fuel cell, etc. in a fuel cell. The unit cell which produces electromotive force according to the electrochemical reaction of oxygen content gas and hydrogen content gas in these fuel cells, While intervening between the unit cells by which this unit cell by which the laminating was carried out adjoins each other, contacting the electrode of both adjacent unit cell and connecting this both unit cell electrically, it has the separator which makes the operation which separates reactant gas, and substantia-compacta carbon material is used for a polymer electrolyte fuel cell and a phosphoric acid mold fuel cell as this separator, and the nickel/SUS clad plate is used for the fused carbonate fuel cell.

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EFFECT OF THE INVENTION

[Effect of the Invention] Since according to the 1st invention the separator for fuel cells was formed by the metal member, direct gold plate was performed to the contact surface with the electrode of a unit cell, the contact resistance of this separator and this electrode falls and the flow of the electron to this electrode becomes good from this separator, the output voltage of a fuel cell becomes large. Since according to the 2nd invention this metal member was used as stainless steel and corrosion resistance becomes good, endurance improves. Since according to the 3rd invention this separator meets this electrode, and forms the path of reactant gas and it becomes possible to form a reactant gas path with the easy metal separator of shaping, the productivity of a fuel cell improves. Since thickness of gold plate was set to 0.01-0.06 micrometers, while according to the 4th invention the contact resistance of the separator for fuel cells and the electrode of a unit cell becomes still smaller and the output voltage of a fuel cell improves, a cost cut is attained, in order that there may be little amount of the gold used per this separator and it may end.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the separator which used the separator and nickel/SUS clad plate which used these substantia-compacta carbon material has the trouble that contact resistance with the electrode of a unit cell is large. Then, this invention is made in order to cancel this trouble, and let it be a technical problem to offer the small separator for fuel cells of contact resistance with the electrode of a unit cell.

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MEANS

[Means for Solving the Problem] The separator for fuel cells of the 1st invention consists of a metal member, and is characterized by performing direct gold plate to the contact surface with the electrode of a unit cell. The separator for fuel cells of the 2nd invention is characterized by using this metal member as stainless steel in the separator for fuel cells according to claim 1. The separator for fuel cells of the 3rd invention is characterized by countering with this electrode and forming a reactant gas path in the separator for fuel cells according to claim 1 or 2. The separator for fuel cells of the 4th invention is characterized by setting thickness of gold plate to 0.01-0.06 micrometers in the separator for fuel cells according to claim 1 to 3.
[0005] By performing direct gold plate to the contact surface with this electrode of this separator, the contact resistance of this separator and this electrode becomes small, and an electronic flow is performed good between this separator and this electrode.
[0006]
[Embodiment of the Invention] Although aluminum, titanium, nickel-iron alloy, stainless steel, etc. can be used for a metal member, it is desirable to use stainless steel from a viewpoint of corrosion resistance. Although the reactant gas path formed between a separator and an electrode may form and form a slot to an electrode and irregularity may be prepared and formed to a separator, when especially an electrode is a product made from carbon, it is desirable to prepare metal separator irregularity and to form a reactant gas path. Although the thickness of the gold plate performed to a separator is not restricted, since it became clear that contact resistance becomes especially small and does not have generating of a pinhole, either, when this thickness is set to 0.01-0.06 micrometers as a result of the experiment, as for the thickness of this gold plate, it is desirable to be referred to as 0.01-0.06 micrometers. This separator is employable as various fuel cells, such as a polymer electrolyte fuel cell, a phosphoric acid mold fuel cell, and a fused carbonate fuel cell.

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EXAMPLE

[Example] Hereafter, the separator for fuel cells adopted as a polymer electrolyte fuel cell is explained as an example of this invention based on drawing 1 -5. As shown in drawing 1 , the separator 1 for fuel cells of this example is what used stainless steel (SUS304), the circulation hole 3 for reactant gas installation, the circulation hole 4 for a reactant gas outflow, and the cooling water circulation hole 5 are drilled in the periphery section 2, and the bulge shaping section 7 which consists of many irregularity by press forming is formed in the inner circumference section 6. The gold plate layer 9 with a thickness of 0.01-0.02 micrometers is formed in the bulge tip side edge side 8 of the bulge shaping section 7. As shown in drawing 2 , in case a fuel cell is formed, a separator 1 intervenes among the unit cells 10 and 11 by which the laminating was carried out, it is arranged so that the electrodes 12 and 13 of the unit cells 10 and 11 and the gold plate layer 9 formed in the bulge tip side edge side 8 of the bulge shaping section 7 may contact, and forms the reactant gas path 14 between a separator 1 and an electrode 12.
[0008] The gold plate layer 9 of a separator 1 carried out and formed the washing process, the parcel-gilding stroke, the washing process, and the desiccation process in this sequence the cleaning process, a washing process, and surface activity chemically-modified degree, without performing substrate plating to the separator material by which press forming was carried out. At a cleaning process, the fats and oils which adhered to the front face of a separator material using the strong-base system degreaser are removed. To a surface activity chemically-modified degree, using an inorganic mixing acid and an organic system inhibitor as a processing agent, while activating the front face of a separator material, it graduates. In a parcel-gilding stroke, parcel plating is carried out to the bulge tip side edge side 8 of the bulge shaping section 7 of a separator material using the sparger method which blows off plating processing liquid from the nozzle which impressed the electrical potential difference to the separator material in the plated section, and forms a partial deposit, using a cyanogen golden potassium solution as plating processing liquid.
[0009] In order to investigate the effect of the gold plate layer 9 exerted on the contact resistance of a separator 1 and the electrodes 12 and 13 of the unit cells 10 and 11, as shown in drawing 3 , the flow resistance at the time of an electron flowing in a separator 17 through an electrode substrate 16 from a separator 15 was measured. Hereafter, it explains in full detail about measurement of flow resistance. As shown in drawing 3 , the electrode substrate 16 which consists of the same component as the electrodes 12 and 13 of the unit cells 10 and 11 is pinched between the separators 15 and separators 17 which consist of the same structure and the same quality of the material as a separator 1. Furthermore, a separator 15 and a separator 17 are pinched with the collecting electrode plates 19 and 20 of a pair linked to a constant current power supply 18. When a fixed current is supplied between a separator 15 and 17, a separator 15 and the potentiometer 21 by which series connection was carried out among 17 detect a separator 15 and the potential difference produced among 17, this potential difference is converted into resistance, and flow resistance is acquired. Under the present circumstances, collecting electrode plates 19 and 20 are grasped with the press plates 24 and 25 through electric insulating plates 22 and 23, the press plates 24 and 25 are pressed with press equipment

(not shown), and the planar pressure of predetermined magnitude is applied to the bulge tip side edge sides 26 and 27 of separators 15 and 17.
[0010] The thickness of the gold plate layers 28 and 29 formed in the bulge tip side edge sides 26 and 27 of the separators 15 and 17 under fixed planar pressure at drawing 4 and relation with flow resistance are shown. when flow resistance became small and became smaller than 0.06 micrometers so that from drawing 4 , and the thickness of the gold plate layers 28 and 29 became thin, it became clear to become flow resistance of about 1 law.
[0011] Relation between the flow resistance at the time of changing the planar pressure applied to the bulge tip side edge sides 26 and 27 of separators 15 and 17 to drawing 5 , and planar pressure (inside of drawing)

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view of the separator for fuel cells which is the example of this invention.
[Drawing 2] It is the sectional view showing the contact condition of the above-mentioned separator for fuel cells, and a unit cell.
[Drawing 3] It is drawing showing a means to measure flow resistance.
[Drawing 4] It is the graph which shows the relation between the thickness of a gold plate layer, and flow resistance.
[Drawing 5] It is the graph which shows the relation between planar pressure and flow resistance.
[Description of Notations]
1 Separator for Fuel Cells
8 Bulge Tip Side Edge Side
9 Gold Plate Layer
10 Unit Cell
11 Unit Cell
12 Electrode
13 Electrode
14 Reactant Gas Path

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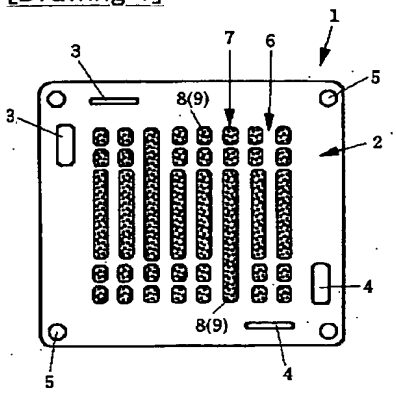
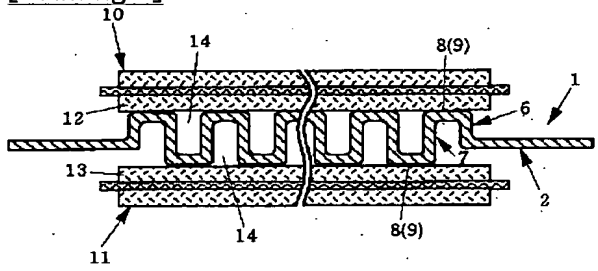
DRAWINGS

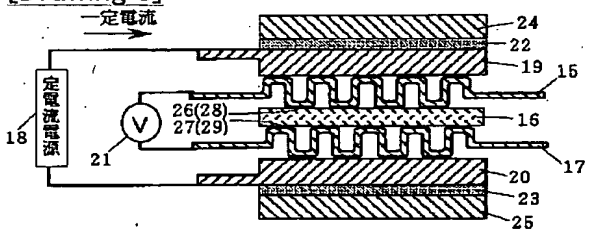
[Drawing 1]



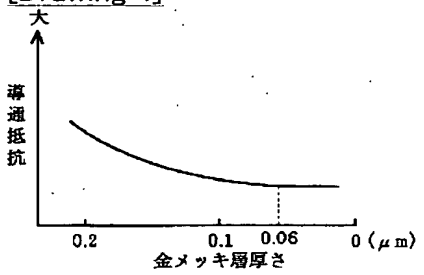
[Drawing 2]



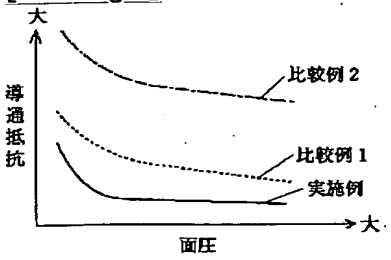
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]